4. The mortality of the mothers is not augmented, and the ratio of stillborn children, if at all, is so slightly increased as to amount to a minimum.

5. The causes are not well defined. The repetition of the accident in certain women shows that with some a tendency is inherent. A possibility of atmospheric influences, especially a low temperature, as an exciting cause is admissible. Smellie considered obesity a cause. My observations have not confirmed his statement. Cazeaux considered that such cases were coincident with a presentation of the vertex that is deeply engaged in the excavation.

6. It is probable that the duration of labor is shorter in cases where the appearance of pains is delayed for some time after the membranes are ruptured.

7. The proper plan of treatment as given by Smellie, McClintock, Bard, Denman, and Dewees, and corroborated by my own experience, *is rest*, if necessary in a recumbent posture, *and patience.* All efforts to excite labor-pains are hurtful, meddlesome, and mischievous. *Wait for pains, and treat the case on general principles!*

8. Finally, that the fear of delay and danger in this class of cases,—the classical "dry labor,"—promulgated by our early obstetrical fathers, and endorsed by successive authors generally, is based on the merest spark of truth, and is one of those medical traditions that experience shows to be over-estimated and to a large degree apocryphal!

ARTICLE IX.

A CONTRIBUTION TO THE PATHOLOGY OF MALARIAL FEVER.

By W. T. COUNCILMAN, M.D., Associate in Pathology Johns Hopkins University, and A. C. ABBOTT, M.D., Baltimore, Md.

IN the summer and autumn of 1884, an unusually good opportunity was given to the writers for the study of the pathological lesions produced by malarial fever. Bay View Asylum, the almshouse of the city of Baltimore, receives a large number of malarial cases from Harford County, and other of the more malarious counties of the State. Most of these cases received in the time named were of the ordinary type, recovered soon under the use of antiperiodics, and left the house. There were, however, several cases, nine in all, that died either from the disease itself, or from some other affection that intervened in the course of the disease. Post-mortems were made on these cases a very short while (four or five hours) after death, and most of the organs subjected to a critical and prolonged microscopic examination. Two of these cases died from a form of malarial poisoning, which, though not uncommon in the South, and especially in Algeria, is not met with very often in our latitude.

These two cases were particularly interesting from certain changes found in the contents of the bloodvessels in the brain and other organs. These changes will be described at length, because they seem to shed some light on various observations which have been made by French authors in Algeria and elsewhere.

CASE I.—An unknown man was sent to the almshouse from a low boarding-house on Market Space. He was received September 12th, at 5 o'clock in the afternoon, and was then in a profoundly comatose condition; temperature in axilla 101.4° Fahr. No history could be obtained from the men who brought the patient, and of course nothing could be learned from the patient himself. He died during the early hours of the morning. On making inquiries from the keeper of the small boarding-house where the man had lodged, nothing more definite could be learned than that he was a laborer, and had, probably, worked at some of the excavations along the railroad. The day before the man was sent to the asylum, after two or three days' residence in the boarding-house, he was taken sick; complained of drowsiness, loss of appetite, and general weakness. His condition gradually became worse, and the next morning he fell into a comatose condition from which he never rallied. The post-mortem examination was made September 13th, at 9 A. M., five hours after death.

Body large; tolerably well nourished; anterior surface of the body pale, on the posterior surface a good deal of post-mortem congestion; no œdema. Scalp pale; skull of ordinary thickness; dura mater lightly adherent; pia mater slightly thickened and œdematous, easily stripped off from the surface of the brain. The cortex of the brain was throughout of a dull chocolate color. This color seemed more pronounced in the gray than in the white matter, although the white matter was slightly darker than normal; the line of demarcation separating the white from the gray was apparently more pronounced. This sharp demarcation gave the gray matter the appearance of being lessened in width. The central ganglia of the brain partook of the same color as the cortex. The pia mater of cord hyperæmic; the cord itself darker; the gray matter of the same color as the cerebral cortex. The thyroid small. In the trachea a small quantity of mucus. Its mucous membrane, as well as that of the pharynx, larynx, and œsophagus, very pale and anæmic. In the pericardial cavity, a slight quantity, about 1½ oz., of slightly yellowish serum. Heart's flesh firm; its valves normal. Both lungs intimately adherent to the pleura. Lung tissue inflated and contained much pigment. At the anterior edges of both lungs there was a slight degree of emphysema. The peritoneum smooth and glistening; liver enlarged (4 lbs. 12 oz.), soft, and of a dark slaty color; on cutting its tissue, it was found very hyperæmic. Spleen was very much enlarged, 7 inches long, 4 wide, and 2 thick, and of an almost black color, with a tinge of gray. Kidneys of ordinary size, capsule easily stripped off. The cortex full and hyperæmic; no pigmentation could be made out. In the small intestine, fluid contents tinged with bile; mucous membrane normal. Large intestine distended with gas and fecal matter. Pancreas of ordinary size, color, and consistency; stomach empty, its mucous membrane slightly hyperæmic, and in several places there were small hemorrhagic erosions. Supra-renal capsules in no way changed. Bladder slightly distended. The voluntary muscles and subcutaneous tissues presented no abnormal discolorations. Small portions of the spleen, liver, kidneys, lung, brain, and cord were placed at once in a large amount of absolute alcohol for microscopic examination. In addition, pieces of the brain and cord were placed in Müller's fluid.

Spleen.—Microscopic examination showed considerable passive congestion in this viscus. There was a large amount of pigment present, which appeared principally under two forms. In one form the pigment granules were large and irregular in shape, though generally with rounded outlines. The pigment was of an intensely dull black color. These irregular pigment masses were of various sizes, from mere granules up to the size of a white blood-corpuscle and larger. They were both free and inclosed in cells which were apparently white blood-corpuscles. The second form under which this pigment appeared demands special consideration. It was inclosed in numerous extremely small hyaline-looking bodies. The most of these were about one-third the diameter of a red blood-corpuscle. They were generally rounded, but sometimes slightly irregular in outline. They seemed to be composed of a pale, almost hyaline, or very slightly granular substance, which was stained slightly by Bismarck brown, and gentiana violet. This staining was so slight that it was only certainly seen by the use of the Abbey illuminator without the diaphragm, thereby rendering the color picture much more apparent than when the Abbey was used with diaphragm. Within these small masses a quantity of intensely black pigment was seen, which assumed various forms. When the specimens were examined with a $\frac{1}{20}$th homogeneous immersion without the diaphragm, it appeared in most cases in a horse-shoe shape, similar to the nucleus of a white blood-corpuscle. Sometimes this pigment formed a connected mass, at others it took the form of a collection of separate granules. These granules were so small, that they could only be resolved with lenses of the highest power. In most cases the small hyaline bodies referred to appeared to be in the interior of red blood-corpuscles, usually at their margin. Very often large collections of blood-corpuscles containing these masses were seen; at other times one or two only would be met with in the field of the microscope. Seldom more than one was found in a single corpuscle. In a few cases, however, two were seen. In a few instances the pigment granules seemed to be arranged in the bodies in a circlet. In *all* cases, there was no irregular distribution of the pigment through the masses, but it was always collected together. No pigment was found in the trabeculæ of the spleen. There were some large swollen cells, evidently white blood-corpuscles, which also contained the hyaline bodies. In the majority of cases, these large cells contained the large irregular masses of pigment first mentioned.

Liver.—The liver-cells were of ordinary size, and contained rather more than the usual amount of bile pigment. In the capillaries there was a great quantity of pigment in the form of the large irregular masses described in the spleen. It was seldom lying free in the vessels, but was for the most part inclosed in large cells. These cells were frequently of an enormous size, filling up the capillary bloodvessels for a considerable distance. They were composed of very pale protoplasm, and contained one and sometimes two irregularly shaped and tolerably brightly stained nuclei. They were generally oblong, conforming to the shape of the liver capillary, which they entirely filled. In size, many were three or four times that of a liver-cell, others were very much smaller, and every gradation could be seen from those of the size and general appearance of a leucocyte up to the large masses spoken of. Here and there after long search, a few of the small hyaline masses, spoken of in the spleen, were found both within red blood-corpuscles and the large swollen white corpuscles.

Lungs.—In the lungs there was so much of the ordinary carbon pigment present that but little could be said with certainty about the other pigment; still, without doubt, there was a good deal of the latter contained within the bloodvessels of the alveoli, in cells similar to the large cells spoken of in the liver and spleen.

Kidneys.—The epithelium of the convoluted tubules was swollen and granular, in many cases entirely filling the lumen. There was a slight degree of small cell infiltration around the glomeruli and in other places. The staining of the nuclei of the convoluted tubules was often dimmed in consequence of the extremely granular condition of the protoplasm. A considerable amount of pigment was found in the vessels of the glomeruli, and in vessels of larger calibre which were seen in cross section. This pigment was all contained in large cells. *None* of the small hyaline bodies spoken of elsewhere were found here.

Brain.—On microscopic examination this presented a remarkable appearance; with a low power the bloodvessels appeared as if they were artificially injected with a black injecting mass. On closer examination with an ordinary power of three hundred diameters, they appeared to be filled with very small granules of pigment. By the use of very high powers (oil immersion $\frac{1}{20}$ and Abbey illuminator), the pigment was found to be almost entirely contained in the small hyaline protoplasmic masses spoken of in the spleen. These lay exclusively within the capillaries; sometimes they were inclosed in the bodies of red blood-corpuscles, sometimes they were free. From the great numbers of these masses in the brain they could be studied better here than in any other place. It could be distinctly seen that they were stained and appeared to be composed of a hyaline or very finely granular substance. Their diameter, as said before, was about one-third that of a red blood-corpuscle. The pigment within them presented the same appearance and arrangement as in the spleen. In some, the circular arrangement of the pigment granules was very obvious. There was scarcely a capillary in the gray substance of the brain that did not contain these bodies in greater or less numbers. Some of the vessels were filled with them, and no blood-corpuscles could be seen. Others contained both the hyaline masses and blood-corpuscles. At various places in stainings, made both with Bismarck brown and gentiana violet, hyaline masses were found containing *no* pigment, which stained in the same way and were of the same shape and size as those which contained the pigment. Others were found which contained but one or two pigment granules. The white substance of the brain also contained these pigmented hyaline masses, but in much smaller numbers. The ganglion-cells stained in the ordinary manner, and there appeared to be no change in the histological structure of the brain.

In the specimens examined after hardening in Müller's fluid, the pigment was very perceptible, but the hyaline masses were very difficult to make out. In these specimens another thing was noticed which was not apparent in the specimens hardened in alcohol. Numerous very small hemorrhages were found along the course of the vessels; sometimes but one or two red blood-corpuscles seemed to have escaped, at others the hemorrhage was much larger. It is most remarkable that in these hemorrhages *none* of the pigmented hyaline masses nor any free pigment was found.

Cord.—The cord presented the same general microscopic characters as the brain. The bloodvessels were filled with the pigmented hyaline masses, which appeared to be more numerous in the gray than in the white matter. The blood-corpuscles in sections, both of the brain and spinal cord, appeared to have retained their normal aspect; even when they contained the pigmented bodies they were no paler than normal.

CASE II.—Wm. Burr, æt. 67 years; occupation laborer; born in Mass.; admitted April 22, 1884; died October 9, 1884. He came into the hospital on the above-named date suffering with asthma, which he had had at intervals for several years. He remained under treatment until May 13th, at which time he had sufficiently recovered to be transferred to the "chronic wards." From this time until he died he enjoyed good health, was able to assist the ward master in his daily duties, and ate heartily every day. The first symptom of his last attack was the flighty condition of his mind; this gradually grew worse, and at the end of seven days he was in profound coma and died. While in hospital his urine was albuminous, Bright's disease had consequently been diagnosed, and his present attack was supposed to be one of uræmic coma.

Post-mortem made a few hours after death. Body large, strongly built; muscular tissue well developed; subcutaneous adipose tissue scanty; anterior surface of body pale; posteriorly, some amount of congestion; scalp pale; skull of ordinary thickness and pale; dura mater adherent; pia mater hyperæmic.

The brain cortex presented exactly the same appearance as in the preceding case. It was of a dark chocolate color; ventricles of brain slightly distended with clear serum; meninges of cord slightly hyperæmic; cord itself darker than normal, especially the gray columns of the same, which stood out in bold contrast with the white. Mucous membrane of the larynx, pharynx, and œsophagus pale; a slight quantity of mucus in the trachea; thyroid small; both lungs free from adhesions, posterior portion of lungs very hyperæmic. On pressing the lung substance a slight amount of pus could be squeezed from the smaller bronchi. Mucous membrane of bronchi red and congested. There was a slight degree of eccentric hypertrophy of left ventricle of the heart. Heart's flesh firm, its valves normal. The liver enlarged, weight three pounds, fourteen ounces, and of a dark grayish color. On section, considerable blood escaped. Spleen enlarged, weight one pound nine ounces, and so soft, that when taken in the hand it felt like a bladder full of fluid. It was intensely congested and of a dark, almost black, color.

Kidneys of ordinary size, capsule in some places adherent, so that on pulling it off, portions of the kidney substance were torn away with it. Tissue of the kidneys firmer than normal, cortex slightly diminished in thickness. Intestines slightly distended. In the right tunica vaginalis was a hydrocele as large as a lemon. Marrow of long bones appeared normal.

Microscopic examinations at the time of the post mortem were made of scrapings from the marrow of the bones, and of blood taken from the right heart. In the bone marrow a slight amount of pigment was found, both free and inclosed in cells. The blood, which was of a laky color, contained here and there pigment granules inclosed in white corpuscles.

Portions of the brain, cord, lung, liver, spleen, and kidneys were placed at once in a large amount of absolute alcohol. Portions of the nervous tissues were also hardened in Müller's fluid. An examination of the *brain* showed the capillaries of the gray and white matter, but especially the former, to be filled with small masses of pigment. Examination with higher power, $\frac{1}{20}$ oil immersion and Abbey illuminator, showed the pigment to be contained in the *small hyaline masses* described in Case I. It was distinctly seen that these bodies stained with Bismarck brown. Sections of the brain were also examined both in glycerine and in water without staining. In the sections mounted in glycerine these hyaline bodies could only be seen with the greatest difficulty; this was evidently due to the similarity of their index of refraction to that of the glycerine. In sections mounted in water, on the other hand, they were very easily seen and appeared to be composed either of homogeneous or very finely granular protoplasm. In size they varied from the one-fourth to one-half of that of a red blood-corpuscle. The pigment contained in them assumed various forms—sometimes that of a stellate figure, at other times that of a cross; and some figures appeared not unlike the figures in a nucleus when it is undergoing division.

Especial stress should be laid on the regularity in the size of the hyaline bodies, and the general agreement in character of the pigment contained in them. Generally, the vessels were not distended with red blood-corpuscles, nor were the hyaline masses so often contained in these, as was the case in Case I.

The *spleen* was so crowded with lymphoid cells and red blood-corpuscles that it was difficult to study closely the finer histological details. In numerous places, however, especially in the well-defined bloodvessels, an arrangement of pigment could be made out in all respects identical with that in the brain. Small hyaline masses, which stained faintly with the anilines, were seen, sometimes encased in red blood-corpuscles, at other times lying between them.

In addition to these, the ordinary larger or smaller irregular masses of pigment were found, sometimes free, sometimes inclosed in large cells.

In the *liver* the quantity of pigment was much less than in the brain and spleen; only the irregular masses of it were found in the capillaries inclosed in large cells similar to those spoken of in Case I.

Kidney.—In the kidney the epithelium of the convoluted tubules was swollen and granular. On examination with high power the epithelial cells in many places were found to be converted into large granular masses in which there was no trace of a nucleus. This change was confined solely to the convoluted tubules. Immediately beneath the capsule and in a few other places, some of the glomeruli were shrunken and converted into fibrous masses. In other places there was only a thickening of the capsule of the glomerulus. This change was by no means general in the kidney; in most places the glomeruli were completely unchanged; at two or three points there was a considerable amount of small cell infiltration. Numerous casts were found both in the tubes of Henle and in the collecting tubes. The pigmentation of the tissues was most evident even under a very low power. The pigment seemed here to be distributed with more irregularity than in any other organ examined. It was found in the bloodvessels, in the effused blood at one or two points of hemorrhage, and especially in the glomeruli. It was both free and inclosed in large cells. *None* of the small hyaline masses were found at any point, although a most careful search was made for them.

The lungs showed a slight amount of bronchitis, with a slight cellular exudation into some of the alveoli immediately in the vicinity of the small branchioles. Pigment was found here in the bloodvessels. It could not be said with certainty whether the pigment lying in the tissues outside the capillaries was the malarial pigment or the ordinary carbon pigment of the lungs.

We have described these two cases in full, and it will be found that the gross pathological lesions agree in every detail with the lesions found in the comatose form of malarial fever described by French authors. A case of this form of fever, with a full account of the autopsy, was published by Dr. Meigs, and referred to at length by Dr. Sternberg in his valuable treatise on malaria.[1] In this case, reported by Meigs, an unknown man was brought to hospital in an absolutely unconscious condition, from which he could not be aroused. No further history could be obtained, except that he came from a southern malarious district, and had been suffering from fever. At the autopsy, made four hours after death, the brain was found to be of a chocolate-gray color. On its section surface the delicate tortuous vessels appeared abnormally distinct, and the white substance throughout was of a dull, dirty-gray color. Dr. Meigs remarks, concerning the microscopic appearance of the tissues:—

> "I have never before seen a brain presenting such an appearance; it was leaden-colored throughout, as long ago described by Morgagni, who is quoted at length by Frerichs. The hue of the gray matter was most singular. It looked as though it had been washed over with a not very weak solution of India ink. I examined my specimens with the microscope. In every one of these, all the capillaries were unusually distinct, and were crowded with a black pigment in the form of granules, lying in the calibre, or deposited, apparently, in the walls themselves. There existed, also, scattered through the cortical brain substance, isolated grains of pigment much too large to be embraced in a capillary tube. It was evident that the general dark color of the cerebral tissue and substance of the spinal cord was due to the aggregation of these minute grains and granules. Wherever the blood had gone, it had taken the pigment, filling the capillaries, and lodged it in the tissues. To the naked eye, and more particularly, to the eye aided by a pocket lens, the fine vessels of the white medullary matter were everywhere visible, resembling, as Dr. Bright aptly remarks, 'the appearance produced by scraping the nap of fine cloth on a sheet of white paper.' The color of the liver was an olive green. The term 'bronzed liver' employed by Dr. Thos. Stewardson, in his paper on Bilious Fever, most correctly expresses this appearance."

According to Frerichs,[2] sometimes severe brain symptoms, which speedily prove fatal, are developed after only a few hours of vague indisposition, without any distinct febrile symptoms manifesting themselves. In other cases, a simple intermittent fever has existed for weeks or months, when suddenly a severe fit comes on, which often terminates fatally in an instant.

The first case reported agrees almost entirely, in its history and its gross pathological appearances, with that described by Meigs.

[1] Malaria and Malarial Diseases, p. 177.

[2] Referred to from Sternberg.

In the second case, there was no history of malarial toxæmia, and the man had been a resident of the almshouse since April.

Cases of malarial fever among the physicians and inmates of the asylum, having an origin in the asylum, are not uncommon; but cases of the comatose form *are* uncommon, both in the asylum and in the surrounding country.

It is worthy of notice that a coma of this sort can be mistaken for uræmic coma, especially when the existence of kidney trouble was denoted by an albuminous urine.

That these two cases were cases of malarial coma, the post-mortems leave no doubt. Of especial interest in this connection are the small hyaline masses which were found, particularly in the brain and elsewhere.

Laveran[1] has described certain organisms in the blood and in the tissues of malarial fever patients which lead us to think that he has seen the hyaline masses described by us. He describes these bodies, which he says exist in the blood of all patients sick of malarial fever who have not taken quinine for a long time, when seen under a power of 400 or 500 diameters, as being of three varieties.

Bodies No. 1.—These bodies are elongated, and often curved as a crescent, though some are oval. Their length is 8 to 9 μ, and the width 3 μ; their contour is very delicate and colorless, except where pigment granules are contained in them. These grains of pigment have often a regular distribution in the mass. In blood treated with osmic acid and preserved in picro-carminate of glycerine, it is seen that these bodies have a double contour, and that the central part stains a rosy color, more pale than the leucocytes in the same preparation. They are without motion.

Body No. 2 is described as an organism which presents a different aspect according as it is in motion or at rest. In a state of repose one sees a body a little larger than a red blood-corpuscle. In the interior of this body the grains of pigment are regularly arranged in a circlet, the pigment appearing as minute black pearls. When in motion, very delicate filaments are seen, which are rapidly moved in every direction, and which are attached to the organism. The length of these filaments is three or four times the diameter of a red blood-corpuscle, and they are three or four in number. Sometimes the filaments become freed from the pigmented body, and continue to move in the blood.

Body No. 3 is described as an organism which is spherical in its primitive form, but great variations in its shape and dimensions are found. It contains pigment, arranged in a circlet, as in No. 2.

He says, besides these bodies Nos. 1, 2, and 3, one finds in the blood small, brilliant, round, mobile bodies without specific characters, and grains of pigment of a fiery red or clear blue color. This blue pigment appears to result from a transformation of the red.

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[1] Nature Parasitaire des Accidents de l'Impaludisme, etc. Paris, 1882.

He gives the details of four cases in which the organs were examined after death and in which these pigmented bodies were seen. All of these cases died in coma. The brain was of a chocolate color, and the spleen and liver presented the characteristic appearances. The pigmented bodies were found in every tissue examined. Some, he says, were as large as a leucocyte; most, however, were from one-third to one-fourth that size. He gives various figures of the pigmented bodies, which he thinks are low organisms belonging to the infusoria. At first sight he was inclined to think that they belonged to the amœba, but has given up this idea from seeing the filaments in motion. He thinks the bodies belong to the oscillatoria, and has given them the name of Oscillatoria Malariæ. That the oscillatoria in general play a certain part in the production of malaria he thinks probable, and cites the case from Schurtz[1] of a man engaged in the study of cryptogams acquiring malarial fever after sleeping in a room filled with oscillatoriæ.

Kelsch[2] calls attention to the presence of pigmented bodies in the blood of all patients affected with malarial fever, during the paroxysm, and thinks that their presence or absence should serve as a diagnostic mark. Those bodies described by Kelsch are similar to bodies No. 3 described by Laveran.

From the description which Laveran has given, and from an examination of his plates, it is difficult to avoid the conclusion that the bodies which he has described were leucocytes filled with particles of pigment. The filaments could very well have been threads of fibrin clinging to these. From his figures of the tissues one is led to the same conclusion.

Richard,[3] who has made extensive observations of the blood and tissues of malarial patients in the hospital at Phillipiville, confirms Laveran's discovery, though his description of the microbe differs considerably from that of Laveran and approaches more nearly to what we have seen. The microbe, he says, has a special habitat, the red corpuscle of the blood, in which it dwells, somewhat as the weevil in a pea. In some cases red corpuscles are met with which have a small round clear pocket, with which exception the corpuscle retains its normal appearance; it is simply *stung*, so to speak. Along with these corpuscles others are seen in which the microbe has reached a more advanced form. In the clear spot, a series of small pigment granules are seen, around which the hæmoglobin, easily recognized by its color, forms a ring which retracts as the parasite increases in volume. Finally a stage is reached when there is only a small colorless margin around the parasite, the hæmoglobin having entirely disappeared, and the corpuscle being reduced to a small envelope which encircles the parasite. In this form it is identical with body No. 2 described by Laveran. The appearance seen by him in the red corpuscles he thinks represents the first stage in the evolution of the parasite, a stage which escaped the attention of Laveran.

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[1] Arch. der Heilkunde, 1868.

[2] Contribution à l'Histoire des Maladies Palustres. Arch. Gén. de Médecine, Oct. 1880.

[3] Comp. Rend. Acad. d. Sc. Paris, 1882, xciv. p. 496.

It is evident that Richard has observed the same appearance that we have seen, especially, in the red corpuscles in the brain ; and an observation of Herz, in which he avers that he has found nucleated red corpuscles in the blood of malarial fever patients, makes it seem probable that he has seen a similar condition.

In neither of the cases which we have described was an opportunity given for an examination of the blood during life. Examinations of blood were, however, made in several other cases of malarial fever, and negative results were obtained. In one of the cases small round masses, somewhat similar to the hyaline masses which we have described, were found free in the blood. They were, however, not pigmented. They were regarded by us as small masses of protoplasm resulting from the breaking down of white blood-corpuscles.

What is the nature of these hyaline bodies that we have described? Are they organisms of the same nature as those described by Laveran and Richard, or do they result from some metamorphosis of the cells, possibly the red blood-corpuscles under the action of the malarial poison?

There are several facts which would speak rather strongly in favor of their being lower organisms.

The first is their perfect regularity in size and shape. In all cases where they were found, both within and outside of the red blood-corpuscles, they varied but slightly. Certainly not more than individual bacilli or micrococci of the same species would vary. Another strong point is the fact of their staining with the aniline colors. Though the amount of staining they underwent was slight, it was still perfectly apparent.

The red blood-corpuscles, it is true, will stain with some of the red aniline colors, particularly with eosin, and the acid fuchsin used in staining nervous tissues. It is, however, absolutely known that neither Bismarck brown nor gentiana violet has the slightest staining action on them. It is possible that some metamorphosis might take place in the red corpuscles, which would result in a condensation of the hæmoglobin in a small mass. The action of tannin on human blood and of borax on the frog's blood will produce such a condensation in one part of the corpuscle, leaving the remainder perfectly pale; but the condensed hæmoglobin produced by these reagents does not stain with Bismarck brown and gentiana violet.

In our case, in sections of the brain hardened in Müller's fluid, by which the normal color of the corpuscle is to a great extent preserved, it was perfectly apparent that the red corpuscles, even those containing the hyaline bodies, were not decolorized. Another point is their being found in the brain, *only in the vessels ;* where there was a hemorrhage into the substance of the brain they were *not* found in the extravasated blood-corpuscles. Were they due to any action taking place in the corpuscles themselves it is difficult to see why those corpuscles outside of the vessels should not have undergone the same change as those within the vessels.

We are possibly too prone to look to only one class of lower organisms, —the Bacteria,—as the pathogenic factors in infectious diseases.

As Koch has pointed out,[1] it is perfectly just to suppose that we can have other organisms besides bacteria as etiological factors.

On the other hand, there are strong arguments *against* the supposition that these hyaline bodies are living organisms.

They were only found in certain organs of the body, and here, in the vessels ; it is difficult to conceive the possibility of an organism existing in the blood and carried as an inert piece of matter in the circulation, being heaped up in the capillaries of one part, as these were in the capillaries of the brain, and not in those of another. Why were they not found in the glomeruli of the kidneys, and in greater numbers in the liver? In the latter, as stated, they were only found in isolated instances in Case I., and not at all in Case II., and yet we know that these organs are especially the ones in which insoluble matters carried with the blood stream are most apt to stick. It can hardly be supposed that an insoluble substance in the blood can have a special affinity for a particular organ and be collected there. They were so small that they could pass readily through any capillary in the body. But if they result from any change in the red corpuscles in a congested area, why were they not met with elsewhere in other congested organs? Numerous other pathogenic organisms have been described by various observers in malarial fever.

Salisbury was about the first to enter upon this field. He described in the blood of persons affected with malarial fever an organism belonging to the unicellular algæ. This he describes as a palmella, and claims to have produced malarial fever in persons by having them sleep in rooms containing fresh earth infested with this organism. These statements of Salisbury have now only a slight historical value ; they were never confirmed by any other observers, with the exception of Salisbury's friend and disciple, Ephraim Cutter, of Boston. Lanzi investigated microscopically the flora and fauna of the marshes of the Campagna and the Pontine marshes. He describes a peculiar alteration that the algæ undergo in these localities. Dark granules are found in the endochrome of the cells, which become more and more abundant as the algæ die until they completely fill the cells and give them a black color. In the fall of the year, when the vegetation dies, the microscope reveals the black pigment everywhere in the vegetable

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[1] Mittheilungen aus dem Gesundheitsamt, vol. i.

débris of marshy districts. Lanzi believes that the granules possess the properties of a ferment. They are found abundantly in the dust of the Campagna, and pure cultivations of them in suitable culture media can easily be made. He believes them to be a form of spherobacteria. He thinks the pigment found in the organs is identical with this pigment, and that melanæmia is produced by the heaping up of these granules in the blood.

Afanassieur believes that the small granules of pigment represent a chromogenic bacterium, which is the etiological factor in the production of malarial fevers.

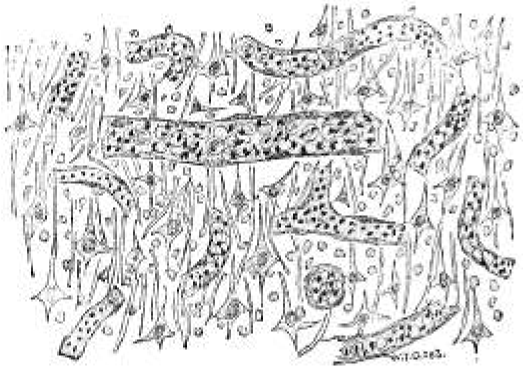
The most important publication, or rather the publication to which the most importance has been given in recent years, is that of Klebs and Tommasi-Crudeli on the "Origin of Malarial Fever." The observers found in the earth of malarial districts certain bacteria, one of which, a bacillus, they supposed to be the essential cause of malarial fever. This organism, which they named the *Bacillus Malariæ*, they cultivated, and claimed to have produced the disease in rabbits by inoculation with the pure culture. Sternberg has repeated in every respect the experiments of these authors, and has in no wise confirmed their results, nor have they been confirmed by any other experienced mycologist.

Marchiafava has found the organism described by Klebs and Crudeli in the blood taken from the spleen during a paroxysm.

Still other organisms have been reported as existing either in the ground in regions where malaria is endemic, or in the blood and tissues of the patients; but little weight need be attached to them.

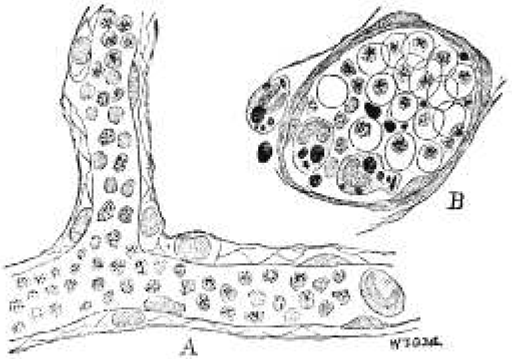
With a view of shedding some light on the subject of lower organisms in malaria, a careful search for the bacilli of Klebs and Tommasi-Crudeli and for any other lower organisms was made in all of the cases of malarial fever which have come under our observation on the post-mortem table. Most of these cases had died of some other disease contracted during or before the malarial attack. Some had certainly died of malarial fever. The organs were taken from the body a few hours only after death, and before any putrefactive changes had taken place. Small pieces of brain, liver, lung, spleen, and kidneys were placed in absolute alcohol, and stained with various reagents and by various methods. No one aniline color was used; most often Bismarck brown, gentian violet, and methylene blue were tried. Sometimes the sections were stained quickly; at others they were exposed to the action of the staining reagents for a considerable time and washed out thoroughly in alcohol. The microscopic examination was made with oil immersion glasses of high power and an Abbey illuminator. In no case were any bacilli, bacteria, or micrococci found. Only in the two comatose cases, which have been fully described, were the singular hyaline bodies found.

Fig. 1.



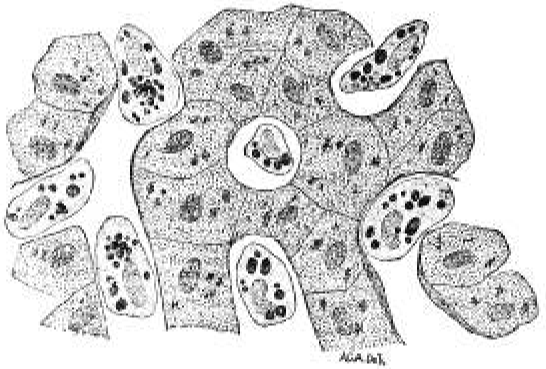
Section of the brain cortex from Case II. The capillaries are seen filled with pigment. × 125.

Fig. 2.



A. Capillary vessel of brain filled with the pigmented hyaline bodies. *B*. Section of a small vein in the spleen. The hyaline bodies are seen generally inclosed in a red blood-corpuscle. The ordinary black pigment in round masses is seen both free in the vessel and inclosed in two leucocytes. In both the brain and spleen some of the hyaline bodies are seen without pigment. × 800 by $\frac{1}{20}$ oil immersion and slightly reduced.

Fig. 3.



Section of liver from Case I. The beam work of liver tissue is seen, and in the capillaries, the large pale pigmented leucocytes. × 500.

This is another argument against the probability of these being micro-organisms. We cannot suppose the comatose form of malarial poisoning to be a special disease, and were a lower organism found in this, we should also find it in other cases.

We present here the facts only as we have found them; we confess our inability to say what these hyaline bodies are. That they have been seen before by other observers appears most likely.

We hope that the paper will direct attention to the subject in localities where this form of malarial poisoning is more common, and possibly with more material at command, and with more skilful observation, the question will be satisfactorily solved.

ARTICLE X.

OBSERVATIONS ON THE CUTANEOUS AND DEEP REFLEXES.

By PHILIP COOMBS KNAPP, A.M., M.D. (Harvard), of Boston.

THE following notes upon the cutaneous and deep reflexes are taken from a series of observations upon 239 persons admitted to the Nervous and Renal Service at the Boston City Hospital, during the latter half of the year 1883. The points noted were the presence or absence of the different reflexes in each patient, a comparison of the reflexes upon the two sides, and a rough estimate of the degree of contraction after the irritation. All the reflexes were tested upon the bare skin, some sharp-pointed instrument—either an æsthesiometer or the point of a pen-knife—being used for the cutaneous reflexes, and a rubber-headed percussion hammer for the deep reflexes.

The cutaneous reflexes examined were the plantar, cremaster, gluteal, abdominal, epigastric, erector spinæ, and scapular.[1] Of these, the plantar reflex was the most constant. In 234 cases it was absent in 17, 10 of which had some direct lesion of the reflex arc, either of the peripheral nerves or of the lumbar cord, six having multiple neuritis, two myelitis affecting the lumbar cord, and two locomotor ataxia. Of the remaining seven cases, three were comatose, two from alcohol, and one from chronic meningitis. The other four will be briefly described as follows:—

CASE I.—Michael M., 49; alcohol to excess; no definite symptoms to be obtained; much mental impairment; general pains and questionable girdle sensation; no evidence of paralysis. In a short time became comatose and died.

CASE II.—Peter M., 58; attacks of vertigo; later, left hemiplegia with contracture; marked mental impairment. In a few weeks became gradually comatose and died. Tumor in corpus callosum.

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[1] A description of these reflexes and the method of testing them may be found in W. R. Gowers' Diagnosis of Diseases of the Spinal Cord, ed. 1884, pp. 17, 18.